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ABSTRACT

Minicourses in astronomy and advanced calculus were offered to students in small rural high schools in New York via IBM PC microcomputers using the graphics tablet and associated software. New York state and local educational agencies, federal agencies, school districts, and two private sector telecommunications companies cooperated to demonstrate how telecommunications could be used to meet curriculum needs of small rural schools. Local community members formed a project advisory council which planned, implemented, and evaluated the project. Course teachers and classroom aides in each remote site received training in equipment set-up and operation and teaching styles stressing protocols for teacher-student interaction. Lectures were given via a telephone bridge with course materials presented via microcomputer to supplement texts and handouts. Students at each remote site were trained in the use of the microcomputer. Progress and success were determined by classroom observation by the project coordinator and by test scores and performance on assignments. Results were favorable for further telecourse development and students were enthusiastic. A detailed description of terminal equipment, telephone bridge, and project costs is provided. (LFL)

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Audiographic Conferencing in Small Rural Schools in New York State: A Model for Developing Shared Teleconferenced Services Between Rural School Districts

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1. Background of Project

The Telecommunications Pilot Project began in January of 1985. It is funded as a cooperative effort between the U.S. Department of Education, the New York State Education Department, the New York State Legislative Commission on Rural Resources, the Delaware-Chenango Board of Cooperative Educational Services (BOCES) and its component schools districts, and two private sector companies -- AT&T Communications and IBM Corp. Its purpose is to examine how telecommunications can be used in rural New York to help meet the needs of small rural schools. The project is particularly timely because of the coming implementation of the Regent's Action Plan to improve education.

2. Method and Structure, Planning for Phase I:

As part of the proposal that funded the project a group of local community members were identified and recruited. The Local Advisory Council was established to oversee all aspects of the project and be responsible for its planning, implementation and evaluation. The group consists of appropriate and interested members ranging from several superintendents of schools to teachers, parents and local officials. The Council also includes Ex-Officio members from each of the funding sources.

The decisions and strategies of the LAC are implemented by the Project Coordinator who works full time in the Educational Communications Division of the Delaware-Chenango Board of Cooperative Educational Services. The Council meets regularly to plan and evaluate. During its first meeting in December of 1984 the Council established a committee format to help things run smoothly. Committees were established in the areas of school selection, curriculum selection, training, publicity, and evaluation.

In January 1985, a survey was conducted asking administrators, teachers, and students what they perceived as needs, and, with their limited knowledge of the project, what they felt would be appropriate applications. The responses from these surveys were used by the committees in their tasks. School selection was based on relatively logistical factors like telephone availability, whether the individual school would be willing to provide an aide at their expense, and if they would be willing to accommodate the scheduling requirements. What resulted was a cluster plan which located six schools as sites based on their willingness to meet the criteria in conjunction with the geographic location they were in. The cluster plan included the option for nearby schools to bus students to any one of six sites.

The curriculum committee met and reviewed the responses of all three groups surveyed (teachers, administrators, students). Using criteria based on the objectives identified for this early phase of the project, astronomy was selected as the content of the mini-course to be offered.

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Once the teacher was selected and an agreement was reached for compensation, training was undertaken. This included reading of several texts and individual instruction from an AT&T consultant. There are two major areas of concern: equipment set-up and operation, and teaching style for this type of delivery system. The teacher and all remote classroom aides were trained individually. None of the aides had any experience with this type of equipment. Half had never used a microcomputer. Each were trained in a one-on-one session (actually it is fairer to say they were "briefed") and one on-line practice session was run.

Time was also spent talking about the telephone bridge. The bridge, though simple to operate, is difficult to explain. It is important the aides understand what is taking place when the bridge if being established and while they are on it in case of a disconnection.

The teacher was trained with considerably more detail. His technical training (equipment operation) was rather comprehensive and included an examination of how the tools of the technology could be used to teach astronomy over the telephone.

By the time the class began, the teacher was very comfortable with the equipment. He had adapted well to presenting his material via the PC, utilizing the functions of the graphics tablet and its associated software.

We also spent considerable time with the teacher discussing style for this delivery system. AT&T Communications representatives were very helpful in this area. Four concerns were identified: humanizing, message style, feedback, and participation. Each of these areas try to compensate for two factors -- the fact that the students are in separate rooms looking at computers, and the teacher's inability to see most of the students. While it may sound somewhat complex it is all rather straightforward. A simple protocol for interaction was decided on and the presentation of the teacher gives attention to participation features. Since the teacher cannot see the students he must get oral and/or visual feedback from them to make sure they understand the material. This system-based necessity also gives telelearning its most potentially positive feature: the necessity for interaction. For this system to work, the students must be involved in the learning process. They must be participants, not recipients. To make this happen we spent a lot of time talking about how we could involve the students in the class.

The students were recruited by the school principals and/or guidance counselors. The goal was to have all seniors. The students were given only limited preparation. This took the form of an orientation package. The package included a master roster, an agenda for the first class, an explanation of the network to be established, and an overview of the concept of telelearning. The students received these materials about a week before the class started.

This class originated from New Berlin High School. It was received by students at Walton, Sidney, Otselic Valley, Sherburne-Earlville, and Bainbridge-Guilford. There were 25 students in the class. The class met 16 times over an eight week period. The class was taught by Wayne Aldrich, a junior high science teacher.

The class was held after school. The students met twice a week for 45 minutes each session. The group met once in person about half way through the class. Every class was observed by the project coordinator. The overall success and problems of each class were noted. The primary evaluation of the class was a seven page instrument that assessed the class in several areas. These included the telelearning medium, course content, class organization, learning effectiveness, and provided space for comments in each area. The results were favorable establishing a positive foundation for further testing.

3. Phase 2 - Advanced Placement Calculus

Currently an Advanced Placement Calculus class is being taught to students at Downsville, Mount Upton, Franklin, and Oxford. It is being taught from Hamilton by Professor Tom Tucker, chair of the math department at Colgate University. Tucker teaches from his home. The class started with 16 students. Three students dropped the class early on and as of this writing there are 13 students.

The class uses the same equipment that the astronomy class used. Each class is equipped with a speakerphone, a personal computer, and a graphics tablet that interfaces the computer acting like an electronic blackboard. The class is networked using AT&T's Alliance Teleconferencing Service.

The instructional design of calculus is different from astronomy. In astronomy the class centered on the group meeting and much of the process was the teacher lecturing. The calculus class meets once a week (Tuesdays at 1:00 PM) as a group using the teleconferencing service and terminal equipment. On Thursdays each location has approximately 25 minutes with the teacher on an individual basis in what we call "office hours". The remaining three days per week are spent doing assigned problems in the textbook "Calculus and Analytic Geometry", by Thomas and Finney. In addition, a published software package called "The Calculus Toolkit" is being used. This package runs in conjunction with the textbook and is available through the same publisher, Addison-Wesley. (This package was intended to be an important part of the class, but for a number of reasons it is being used only marginally at this time. The main reason is the high time commitment already required of the students to meet the textbook assignments.)

The class assignments are due on Tuesday and are mailed to Tucker from each remote school He grades them over the weekend and returns them to the students with a 9-10 day turn around time. Exams are given the same way. These logistics are being handled with relative ease and have not caused any problems since the beginning of the course in September.

All students in the class were selected by local officials, in most cases the building principals with consults from the math teachers and guidance counselors. The group met in person at Colgate before the first class. The orientation session was used to train the students in the use of the equipment and to give them a chance to meet each other. This is a very important step in any attempt at distance learning.

4. Calculus Observations

Progress and success levels in this class are determined in much the same way they are in traditional classrooms. The two main indicators are test scores and performance levels on the weekly assignments. For week to week progress observations the teacher uses the homework assignments. These indicate that the students are understanding the material and are able to apply it. The test scores are more clearly indicative of the success of the class. The first test was given in early November. The median score for this test was 72. In comparison, the median score for the freshman class at Colgate given a similar test is between 78-80. While there is only a slight difference in test scores, there is a dramatic difference in contact time. The Colgate class received 11 classes of face-to-face instruction, while the telelearning class only had five group meetings via teleconferencing. The second test administered in the last week of November had a median score of 75.

According to Tom Tucker these are possitive indicators.

In my conversations with the students I have found most of them to be enthused about the program. They do find the material difficult and it requires a great deal of their time. In some cases, it requires more time than all other classes combined. Overall they seem to be accepting the teaching method.

5. The Equipment:

A. The Terminal Stations

The equipment that was selected for the pilot is technically referred to as audio-graphic teleconferencing equipment. it is a PC-based system that incorporates a graphics tablet which functions very much like an electronic blackboard. The system runs on specially designed software that, once on-line with other similar PC's, operates on a common screen basis. Whatever is executed from any one location shows up at all the others in real time. The system has two uses: presentation and/or interaction. The teachers (or students) can prepare pages individually and store them on disk. The disks are then distributed and when on-line, can be called up out of each PC simultaneously. The system also has the capability for real time interactive writing and/or annotation on blank or existing screens. Other features of the system include: selective or total erase, two color capability, an on-screen pointer, and the ability to transmit prepared pages thus eliminating the need to copy and distribute disks. (See Optel Specifications for further information).

The system requires an IBM PC with 256K, color/graphics card, color display, and two asynchronous communication ports (RS232). The Optel package includes the tablet, its power supply, software, cables, and a specially designed modem. The "Voice Too" specially designed modem. The "Voice Too" modem is a 300 baud modem (type 103) that was designed specifically for Optel. This modem uses a frequency specific filter to accommodate both voice and data transmission over the same standard dial-up telephone line. (This is one of the most significant cost features of the Optel system.)

Along with the above, speakerphones are in each class. The speakerphones are manufactured by Plantronics, Inc. (Santa Cruz). The speakerphones cost $300. They were selected because of their fast switching which eliminated the clipping associated with most speakerphones. In addition, they have an infrared remote microphone that can be clipped in a shirt pocket or on a lapel or be put on a stand.

B. The Bridge

The bridge that establishes the network is called Alliance. It is offered by AT&T and is rather simple. It is a computer that you call into that allows you to set up a "meet me" bridge. A meet-me bridge is a switching device that people call into to meet on. Alliance is essentially the same thing, but it is user controlled and all the calls are originated in one site. There are four Alliance bridges in the country. The one we use is in White Plains. The call is initiated from the origination site, and all the locations are brought on the bridge following the simple prompts offered by the Alliance program. The bridge has many useful features including indicators for dropped parties and automatic re-dial.

6. Costs

Hardware and associated communications software:

IBM PC XT	
with option cards	- 2700
Optel Telewriter II-PC	- 4650
Speakerphone	- 300
Printer	- 500
Total	$ 8150

Group Speakerphone: AT&T $1550
TSI $2400

Some of these costs may change slightly in the next year.

2. Program Costs

A. Courses shared between two schools

- compensation for teacher
- any associated Long Distance charges

(Estimate for a full year class meeting in a structure similar to current calculus class would cost each school-between $3000-3500.)

B. One-time events using speakerphone only - long distance charge only (i.e. 1 hour call with South Africa cost $100)

C. Courses taught from one school to several others

- compensation for teacher
- Bridge charge (# of min. per week x .25 x # of weeks x # of schools)

Ex.: 50 min. x .25 x 34 x 6 = $2550
150 min. x .25 x 34 x 6 = $7650

- LD charges from Bridge to each school (based on V & H Tables all prices are the same, generally cheaper than local long distance. Current rate is .37 a minute.

(.37 x min/week x weeks x location)

Ex.: .37 x 50 x 34 x 6 = $3774
.37 x 150 x 34 x 6 = $11,322

	For 50 minutes	For 150 minutes
Bridge:	$ 2,550	$ 7,650
LD:	3,774	11,322
Teacher:	4,000	4,000
Office: hours	1,200	
TOTAL:	$11,524	$22,972
divide by 6 =	$ 1,920 ea.	$ 3,328 ea.

For more information contact Denis J. Martin (607) 334-2771.